



## Foreword



Ülo Lepik

Photo by Estonian Academy of Sciences/Reti Kokk

Ülo Lepik celebrated his 100th birthday in July 2021. This was a remarkable event not only for him but for all scientists and scholars in Estonia. It was proof that a scientist is a creator, and his emotional charge keeps him active as long as he can think. With over 100 years of age, Ülo's life has witnessed complicated periods in Estonian history. Born to independent Estonia in 1921, he was recruited to military units during WWII, lived under the Soviet occupation, and only the last 30 years again in an independent country. An inquisitive mind always finds a way out of the surrounding problematic environment and Ülo Lepik has always been an independent thinker with clear views. Besides research, he has shared his knowledge with students at the University of Tartu, the only “master” throughout his life, if not counting sabbaticals in other countries. It is said that Ülo is a scientist *par excellence*. His studies have covered many branches of mechanics – an old discipline with a glorious history but always generating new ideas. “Mechanics shaped the modern world,” stated David H. Allen. Indeed, ancient buildings and knowledge about the motion of planets are well-known signs of the application of mechanics. After Isaac Newton

formulated his *Principles* in 1687, the studies in mechanics got a solid foundation. It is remarkable that at the University of Tartu where Ülo Lepik taught students for almost 50 years, the theories of Newton were introduced already in 1690 by Sven Dimberg. Accordingly, Ülo has been a dignified follower of traditions in studying and teaching one of the most important disciplines for almost half a century, starting in 1948.

Much has been changed since the 17th century, new ideas and new problems have emerged and Ülo Lepik has always been keen on looking for innovative solutions. Even a shortlist of problems studied by him is impressive:

- stability of elastoplastic structures;
- nonlinear theory of plates with large displacements;
- mechanics of rigid-plastic materials;
- optimisation of structures;
- chaos in stochastic systems;
- analysis of wavelets.

Ülo's study visits to Moscow, Warsaw, and Providence have helped him to formulate fresh ideas and establish a broader network for cooperation with colleagues. His studies have demonstrated how theoretical issues can be developed into practical applications. An excellent example is using the Pontryagin's maximum

principle for solving the problems of optimisation. It is noteworthy that with 80 years of age, his interest in using Haar wavelets for finding solutions to many practical problems was further realised in numerous papers and an excellent monograph by Springer (Ü. Lepik and H. Hein “Haar Wavelets with Applications”), published in 2014. This monograph is a magnificent example of how an old idea (proposed in 1910) has undergone a new birth from the 90s of the 20th century and can effectively be used for solving a wide range of problems even today. The authors themselves conclude that “the Haar wavelet method is much more elegant in theory, more convenient in numerical calculations and, most of all, it is much faster in data processing.” Actually, these features (elegant, convenient, etc.) associated with the topic are so characteristic of all the activities of Ülo Lepik over his long research career.

In this Special Issue, a collection of papers is published reflecting the scientific interests of Ülo Lepik. Some papers are devoted to the analysis of vibrations (Sorrenti et al., Lellep and Lenbaum), some to the general problems of mechanics: finding eigenvalues (Maiti and Chakraverty) and solving diffusive inverse problems (Janno et al.), but most papers describe the applications of Haar wavelets (Aziz et al., Hein and Jaanuska, Cattani, Mehrparvar et al.). In this way, the collection represents studies in most of the areas where Ülo has been active for a long time with outstanding results. His full bibliography has been published by the University of Tartu (“Ülo Lepik. Bibliograafia 1948–2005”, Tartu Ülikool, Tartu, 2005).

Not only his close colleagues but the whole Estonian scientific community congratulate Ülo Lepik on his anniversary and thank him for being a real lighthouse of the scientific mind.

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Editor